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How Does a Radio Altimeter Work and 5G?

The radio altimeter is not considered a basic flight instrument. It can be found in many aircraft. The radio altimeter is also known as radar altimeter and is abbreviated as RA. The instrument indicates the height of the aircraft above the ground immediately below it. This is not the height above sea level. It indicates the AGL height of the aircraft in real time.

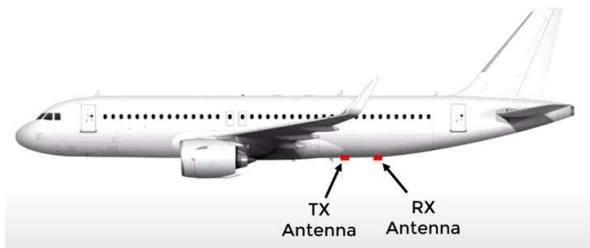


Figure 1 Antenna Placement



Figure 2 Processing Unit



Figure 3 Instrument

The basic components are two small antennas located on the bottom of the fuselage. One is a transmitting antenna and the other a receiving antenna. The two are connected to a processing unit that

generate the transmitted signal and decodes the received signal. The final component is the instrument or indicator in the cockpit.

First the Tx antenna emits a radio wave downward from the aircraft. This signal bounces off the ground and is reflexes back to the Rx antenna. The processing units uses the travel time based on the speed of the radio wave, the speed of light or “c”. The AGL height is determined using the time and the speed of the radio wave.

A more detailed look reveals that a continuous wave that is frequency modulated is used. The Super High Frequency (SHF) signals are in the range of 4200 to 4400 MHz. The elapse time is not measured directly but the difference in the frequency, Δf , of the wave. The processing unit knows the rate at which the frequency is changed in Hz/second, r . The change in frequency and the rate of change of the frequency, FM radio-wave yields the change in time, $\Delta t = r \cdot \Delta f$.

Assume the Tx antenna is currently transmitting radio-wave at the frequency of 4350 MHz and the Rx antenna is receiving a signal at the frequency of 4300 MHz. Therefore the change in frequency, Δf , is 50 MHz.

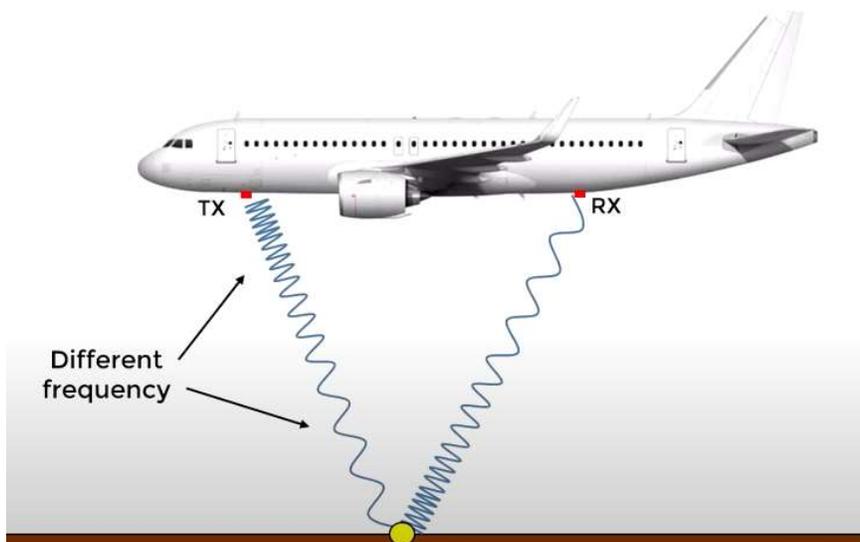


Figure 4 The Bouncing FM Signal

To calculate the distance the signal travels, $2 \cdot \text{AGL}$, the processing unit multiplies the change in time by the speed of the radio wave. Therefore $2 \cdot \text{AGL} = \Delta t \cdot c = \Delta f \cdot r \cdot c$, or $\text{AGL} = \frac{1}{2} \cdot \Delta f \cdot r \cdot c$. The $\frac{1}{2}$, r , and c can be combined into constant, say $2000 \text{ ft} / 400 \text{ MHz} = 5 \text{ ft/MHz}$. The result is $\text{AGL} = 5 \cdot \Delta f$ where Δf is measure in MHz.

The FAA and FCC are currently at loggerheads over the use of 5G broadband cellular networks services near airports. The FCC has allocated three bands for 5G. The low band is 600 to 900 MHz.

The mid-band is 2300 to 4700 MHz. And the high-band is 24,000 to 47,000 MHz (24 to 47 GHz). Note there is overlap in the 5G mid-band and the RA band of 4200 to 4400 MHz.

RAs are essential for safety in ILS conditions. The FAA is not sure that this 400 MHz wide band used by RAs will not be interfered with by the mid-band 5G signals. There is a temporary period of time in which 5G network provider will voluntarily not activate 5G near 50 airports of the FAA choosing.

Other countries, such as France have already certified that the mid-band 5G will not interfere with RAs. Boeing has also certified that the RAs used in the 787 aircraft work properly in the presences of 5G mid-band signals.

The RAs work portion of this article is based on the material presented in the YouTube video [How Does a Radio Altimeter Work?](#)

Herbert's Obituary, W8IPE/SK

Herbert J. Bushong went to be with His Lord and Savior, Jesus Christ, on Tuesday, January 18, 2022, following a brief, yet courageous, battle with cancer. He passed at home surrounded by the love of his family and kisses from his wife, Carol.

Herb was born in McArthur, Ohio to Herbert Isaac and Clara Bushong on April 23, 1947. He grew up in Ohio and graduated from Louisville High School in 1965. A lifetime learner, he took 1-2 classes at a time while working full-time to support his family. His persistence earned him an associate degree from Stark Technical College followed by a BS in Industrial Engineering from Kent State University in 1993.

Herb met the love of his life, Carol, at church during their teenage years where they dated through high school and married on January 21, 1966. They have four sons, Herbert L., Charles "Chuck" who preceded him in death on January 5, 2022 (Lisa), Christopher (Angela), and Douglas (Dawn). In total Herb and Carol have 4 children, 6 grandchildren, and 2 great-grandchildren.

Herb has three brothers, Archie, Russell, Bill, and four sisters, Isabelle, Judy, Jennifer, and Susan, and many nieces and nephews.

Herb retired as a Quality Control Engineer and Quality Manager after a 30-year career at Kaiser Aluminum (previously Winters Industries). Prior to then, he worked as a manager at Denny's restaurant and various other jobs.

Herb enjoyed boating, fishing, tomato farming (which he loved to share with others), newspaper comics, sudoku puzzles, museums (he read every word), gospel music, science fiction, and visiting historical sites.

As a licensed Amateur Radio operator, Herb, W8IPE, was an active member of HAM Radio clubs for more than 4 decades. During Field Day, Herb would provide guidance, experience, and his delicious, fluffy omelets that only he could make.

Herb was a true servant leader that always focused on what he could do to enrich the lives of others. He will be missed by all who knew him.

Newsletter Articles

The newsletter needs a few authors to write a short article to be included in the quarterly newsletters. The article should relate to amateur radio either completely or tangentially. Pictures are encouraged. Email them to N8PZL@arrl.net. Grab that keyboard or pen and write away.

Upcoming Event

Time: Feb 19, 12:00 AM (Noon)

Place: We will meet at Papa Bear's, 4990 Dressler Road NW, Canton, OH 44718 for lunch. After lunch we will have a presentation by Mel Vye about his trip to the the Arctic Circle to see aurora borealis.

Please RSVP by 17 February via email to virginislesun@yahoo.com, Tom Price
Hope to see you on the 19th.

New Officers

We now have some new officers and some hold overs. Tom Price moved up from vice president to president as required by the By-Laws. Mel Vye is the new director and past president and serves along with the other director, Dennis Moriarty. Tom Archer is our new vice president. When reviewing the By-Laws it was discovered that the positions of secretary and treasurer are actually one position of treasurer/secretary. Our former treasure, Les Myers did not run for the



join position and Jim Grover the former secretary agreed he would run and was elected to the position of treasurer/secretary.



Ragchew

Don't forget the monthly ragchew at Tim's Tavern at Noon on the last Wednesday of the month. The address is 3323 Parkway Street NW, Canton Ohio 44708. All are invited. For you information that is Jan 26, Feb 23, Mar 30, Apr 27, May 25. Add these dates to your calendar.

Local Dues

The first of August 2021 was the beginning of the QCWA Chapter 21 fiscal year. If you have not already done so, please pay your local dues at the next meeting or rag-chew. National dues are collected via the QCWA.org web site.



Some Local Hamfests

Check to make sure event has not been canceled due to the 2019 COVID Pandemic.

03/12/2022 – MOVARC Hamfest

Location: Bidwell, OH

Sponsor: Mid-Ohio Valley Amateur Radio Club

Website: <http://www.arrl.org/hamfests/movarc-hamfest-7>

03/13/2021 - Winter Hamfest

Location: Lorain County Community College
Sponsor: Northern Ohio Amateur Radio Society
Website: <https://www.noars.net/>

03/20/2022 – Toledo Mobile Radio Association Hamfest & Computer Fair

Location: Perrysburg, OH
Sponsor: **Toledo Mobile Radio Association**
Website: <http://tmrahamradio.org/>

04/09/2022 – Sixty-Sixth Cuyahoga Falls Amateur Radio Club Hamfest

Location: Cuyahoga Falls, OH
Sponsor: Cuyahoga falls Amateur Radio Club
Website: <http://www.cfarc.org/hamfest.php>



04/09/2022 - 66th Cuyahoga Falls Amateur Radio Club

Location Cuyahoga Falls, OH
Sponsor: Cuyahoga Falls Amateur Radio Club
Website: cfarc.org

04/24/2022 Athens Hamfest

Location: Athens, OH
Sponsor: Athens County Amateur Radio Association
Website: <http://www.ac-ara.org/>

04/24/2022 Athens Hamfest

Location: Athens, OH
Sponsor: Athens County Amateur Radio Association
Website: <http://www.ac-ara.org/>

05/20-22/2022 Dayton Hamvention

Location: Green County Fairgrounds, OH

Sponsor: Dayton Amateur Radio Association

Website: <https://hamvention.org/>

